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#33

HAZARD TREE SURVEY IN DEVELOPED CAMPGROUNDS

in the Rocky Mountain Region

345

Assessment of Hazard Trees Within Developed Campgrounds in the Rocky Mountain Region

by

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ABSTRACT

Twenty percent of the Rocky Mountain Region campgrounds requiring fees in 1982 were examined for hazard trees. Fifteen tree species were sampled with 7,312 stems rated for hazard. Less than 20% were rated high risk(HR); 45% were less than HR and 35% were without defect. The average number of trees per campground rated HR ranged from 3 to 58 for campgrounds with less than 10% HR trees to over 50% HR trees. Root rots were underestimated more than any other defect that predisposes a tree to failure.

Species rated HR most frequently were white spruce, aspen, corkbark fir, Engelmann spruce, cottonwood, white fir, blue spruce, and lodgepole pine in descending order. Considerable variation exists in the frequency of defects within and between species. The variation is attributed to the frequency of use of a campsite, type user, and tree species mix.

INTRODUCTION

The National Forests host more outdoor recreational use each year than any other recreational system in the country. In 1984 the forests of the Rocky Mountain Region hosted visitor use equivalent to 1.7 days of recreation use by every man, woman and child in the five States composing the Region plus the states adjacent to the Region. A resource used this extensively needs to be well managed to assure continuous availability and quality recreational experience.

Trees are a prime environmental feature at most recreation sites. They often develop defects as they are continually exposed to impacts created by people, aging, and the elements of nature. Some defects ultimately lead to the structural failure of portions of a tree or the entire tree. Failures that result in property damage, injury or death of a person, are of concern to us.

As Federal resource managers, we have a duty to exercise prudent care to maintain recreational areas in a reasonably safe condition. We encourage the public to visit the forests. The collection of user's fees, such as in developed campgrounds, serves to further emphasize the responsibility of the "duty of care". With increasing public pressure on the recreational resource and diminishing budgets for recreation investments, the reduction of Tort claims or administrative settlements could allow limited tax dollars to be directed toward maintenance and improvement of developed sites rather than being diverted to the settlement of damage claims for people or property.

In 1982 a regional assessment of hazard trees within developed campgrounds in the Region was initiated as a result of two incidents:

1. A tree failure on July 11, 1980 in the Region resulted in the destruction of a van and trailer and caused personal injury that resulted in a Tort Claim.

2. The failure of 67 trees in developed recreation sites on one Ranger District on May 30, 1980. Two of the failures caused property damage.

On July 16, 1980, an investigative team examined trees within two campgrounds on the District mentioned in incident 1. The failed tree causing personal injury was examined. The summarized findings were (Fuller, 1980):

1. The failed tree could have been detected and removed.

2. The reason the tree was not identified was a lack of training of the inspector and lack of supervision.

3. The reason for lack of supervision was the excessive workload and the false feeling of security because the paperwork had been completed in the past and no trees had fallen.

As a result of this investigation two concerns were surfaced:

1. Were individuals who inspect developed campgrounds for health and safety trained to recognize and evaluate hazard trees?

2. What was the hazard tree situation in developed campgrounds throughout the Region?

The first concern was addressed by a Hazard Tree Instructor Trainer (HTIT) workshop in Denver on May 18-20, 1982. One individual per Forest attended the session and became the instructor for the Forest. Upon completion of training, each instructor was given a 90 minute slide/tape training package to use in the instruction of inspectors on the Forest.

The second concern resulted in a Region-wide survey of developed fee campgrounds. The findings are the basis for this report.

METHODS

During the summers of 1982 and 1983, 7,312 trees were examined and rated for hazard. The trees were in 54 campgrounds within the 12 recreational Forests of the Region. The campgrounds represented 20% of the Region 2 campgrounds requiring fees in 1982 (Appendix Table A-1).

The campgrounds and the campsites within a campground were selected by use of a random number table. A minimum of three individual campsites were examined in campgrounds that had less than 12 units. Twenty-five percent of the campsites were examined in campgrounds that had 12 or more units.

Trees rated at "risk" for failure had one or more defects that could contribute to its failure, and a target was identified (structure, vehicle, people, etc.). The tree and target were in proximity that damage or injury could occur if the tree failed.

Procedures followed for the hazard tree evaluation are described in the Region 2 HTIT slide/tape training package (Sharon and Steinke, 1982). The risk rating form (R2-2300-11a) is displayed in Appendix A, Table A-2. A three class risk rating system is used for defects. In general, Class I is low risk, Class II is moderate risk and Class III high risk. Risk ratings may be modified by type of target and tree species. Use of the rating system is explained in Technical Report R2-1 (Johnson, 1981). The weighted values assigned to SPECIES and DEFECTS to obtain a RISK RATING were based on Dr. Lee Paines tree failure data for Region 2 (personal correspondence).

Ten percent of the total trees sampled in this survey were cored to confirm structural defect. The trees were selected arbitrarily.

RESULTS AND DISCUSSION

The hazard tree sampling system described in Region 2 Technical Report R2-1 and taught in the HTIT package works well. A few artifacts were created by the weighted values assigned to tree SPECIES and the inclusion of the EXPOSED ROOTS defect in the high risk category III. These will be discussed later.

Fifteen species of trees were sampled for a total of 7,312 stems. Less than 20% were rated high risk (HR). Approximately 27% were medium risk (MR) and 53% were low risk (LR), of which, 2,599 stems had no defects (35.5%).

Species with the highest percent HR trees were white spruce, aspen, corkbark fir, Engelmann spruce, cottonwood, white fir, blue spruce and lodgepole pine, in descending order. The other seven species of trees sampled had 20% or less HR trees (Table 1). Code abbreviations for species are explained in Appendix Table A-3.

On the basis of campgrounds, 40 of the campgrounds had 30% or less of the trees rated HR. Only one campground had more than 50% of the trees rated HR. The average number of HR trees per campground varied from 3 to 58 (Table 2).

Specific defects and their frequency within a tree specie are displayed in Tables 3 to 5. Considerable variation exists in the frequency of defects within and between species. This is expected dependent upon campground use, type of user, e.g., respector or destructor of the environment, tree species, etc. It is beyond the scope of this report to cover in detail each defect/species combination. Patterns and selected defect/species associations are discussed below. To obtain an overview of the current situation in the Region, the reader should study Tables A-5 to A-7 and B-2 to B-4 in the appendices of this report. Data is stratified by species, campground and risk rating. The code index for campgrounds is explained in Appendix Table A-4. The defects within a class are displayed in Tables 3 to 5.

Class I defects (Table 3) are indicators (e.g. slime flux) or may be precursors (e.g. small mechanical wounds) for Class II and III defects. Seldom will a Class I defect contribute directly to a tree failure.

Class II (Table 4) defects can contribute directly to tree failure. Structural damage is frequently associated with these defects. Size of defect, location, presence of microorganisms that kill or decay tissues and species of tree determine the potential for a defect to contribute to tree failure. Some defects, such as cankers, are more common to certain tree species. In this survey 48.3% of aspen had cankers (Table 4); 15.8% of the cankers had decay (Table 5) which made these defects a Class III. Cankers frequently originate at wounds or open branch stubs. Aspen had approximately 33% small mechanical wounds, 20% large mechanical wounds and 20% limb defects. The majority of the mechanical wounds were caused by recreationists. Aspen is extremely sensitive to wounds inflicted by recreationists (Hinds, 1976). Aspen represented 10% of the survey sample.

Cottonwoods are subject to crown failure. The percentages of forking (55%) and limb defects (52%, Table 4) compared to butt rot (13%, Table 5) clearly show that the potential hazard problems are in the crown. Snow load and high winds cause most of the broken and dead branches in the crown. Large living branches with multiple open branch stubs often contain decay. Cottonwood represented 6.2% of the survey sample.

Forking was the most common Class II defect. The forks were primarily "V" rather than "U" forks. In the conifers they ranged from 2% (white spruce) to 22% (limber pine, Table 4).

Frost cracks were observed in all species except green ash, blue spruce and limber pine. The incidence ranged from 1.0% in ponderosa pine to 14% in white fir.

Butt and root rots are Class III defects. Butt rot occurred most frequently in Engelmann spruce followed by aspen, cottonwood, white fir, lodgepole and corkbark fir (Table 5). Approximately 5% of the 15 species sampled were classified as having butt rot. Butt rot was detected by visual inspection and sounding with an axe. Approximately 10% of the total trees sampled were cored because visual inspection and sounding with an axe are not totally reliable to determine decay especially when inexperienced workers are involved. Coring was limited to trees

that were questionable. Not all trees classified with butt rot were cored. Decay was confirmed in 46% of the cored trees (Tables 6 & 7). Cores revealed: 31 stems with less than 24% soundwood; 117 stems with 25-49% soundwood; 211 stems with 50-99% soundwood; and 414 stems with 100% soundwood. The highest frequency of confirmed decay in cored trees occurred in the large diameter classes (Table 7). Species that are known to be susceptible to butt and root rot should be cored if there is doubt, especially when trees are mature or overmature.

Root rots are underestimated more than any other defect; they are especially difficult to detect when:

A. the decay does not extend into the tree butt;

B. the host species does not exude pitch from the infected area;

C. fruiting structures of the fungus are not apparent or they are partially hidden in the duff.

Because root rotters form patterns of decay like fingers extending vertically upwards into the root-bole collar, the decay may be missed by coring between the fingers of decay. Therefore, it is important to examine stumps of previously cut or failed trees in the area. When butt or root rot is suspected, and the first core is fairly sound, an additional core should be made. Trees should be cored as close to the ground as possible. If root rot is suspected a root should be cored. Cores should always be returned to the hole after inspection to limit insect entry. Spores are ubiquitous on insects and some insects are disease vectors.

Root rot was recorded in less than 0.6% of the total trees in the HR category, while butt rot was detected in approximately 26% of the total trees in the HR category (Tables 1 and 5). The occurrence of blowdown and the pattern of decay in stumps of previously cut trees in some campgrounds support the idea that root rots were underestimated.

PROBLEMS OF WEIGHTED VALUES IN CALCULATING RISK RATINGS

Problems were created by weighting the values assigned to SPECIES and assigning EXPOSED ROOTS to Class III defects. Weighted values for species made it impossible for ponderosa pine, limber pine, and Douglas-fir to be rated HR even though a Class III defect existed such as butt rot, root rot, and basal cavity (Tables 1 & 5).

Conversely, assigning EXPOSED ROOTS a Class III defect results in exaggerated risk values, especially for those trees with no other Class III defect. Of the top eight species with the most HR trees (Table 1) blue, Englemann and white spruces and lodgepole pine, many were HR primarily because of EXPOSED ROOTS (Table 5). Using the current hazard tree risk rating form, trees may be assigned a higher rating than they should because they have EXPOSED ROOTS.

To correct these problems the rating values should be modified:

A. SPECIES should have a value of 2 or 3; the 3 value should be assigned only when a tree has a Class III defect.

B. EXPOSED ROOTS should have a value of 2 or 3; the 3 value should be assigned <u>ONLY</u> when the exposed roots are decayed.

Since the current hazard tree risk rating form does not provide these options the recommendation is to use the "comments" column on the form to record the weighted value used for calculating the risk rating.

Only tables in Appendix B have been corrected for the problems mentioned above. Appendix B contains summary tables calculated with the modified rating values. The effect of modifying the rating values is significant. The percent of trees rated HR was reduced from 20% to 14% of the total trees sampled (Table B-1). The shift is primarily due to re-evaluating risk values for EXPOSED ROOTS. The increase in percent trees rated HR that resulted from modified rating values for SPECIES was nullified by the correction for EXPOSED ROOTS.

CONCLUSION

Recreational sites cannot be rendered completely safe. Large trees, old growth, dense stands, dead snags, and large majestic branching crowns are part of the outdoor recreational experience. Unique features of an environmental setting attract and concentrate people. Effects of the public on degrading the environment remain long after they are gone. Educating people can help to ameliorate the rate of deterioration in some recreation areas. Natural events that affect the longevity of developed sites have to be accepted but their effect can be monitored and modified by management. We have a problem agreeing on the risks involved and how much risk is acceptable. The point is that safety is in everyone's interest and it is both wrong and counterproductive to portray otherwise.

Removal of trees and limbs that pose a safety hazard is expensive. Yearly inspection of a site for tree hazards can be costly. However, their combined cost will be less than a Tort Claim in which the Forest Service is found at fault. "Judgemental" risk is involved in evaluating a recreation site. What is important is that decisions be founded on "reasonable" and "responsible" risk.

Results of the evaluation of 20% of the fee campgrounds in the Region indicate considerable variation in the amount of deterioration of vegetation between campgrounds, sites and species. There are recreational sites that should be of concern. Priorities should be determined for their renovation or closure. A cost effective approach for estimating local budgets for hazard tree control in recreation sites (Paine, 1967) is included in Appendix B. This approach could be used for prioritizing work to be done and for building a framework for future funding.

Hazard tree evaluation is an art. It is being taught by a hazard tree instructor on each Forest. It is being learned. A lot of practice is needed to get good at it. "Judgemental risk" cannot be taken out of evaluating a questionable tree, but, experience can teach us what is a reasonable risk. The best program for hazard tree reduction is prevention, and vegetative management is a step to prevention.

REFERENCES

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DISTRIBUTION OF TREES RISK RATED FOR
HAZARD IN 54 CAMPGROUNDS IN REGION TWO

TABLE 1

TREES PER RISK RATING

SPECIES *	NUMBER OF TREES SAMPLED	PERCENT OF ALL SPECIES SAMPLED	NUMBER WITHOUT DEFECT	NUMBER OF STEMS LOW (1-9)	NUMBER OF STEMS MED (10-20)	NUMBER OF STEMS HIGH (21-27)	PERCENT OF STEMS LOW (1-9)	PERCENT OF STEMS MED (10-20)	PERCENT OF STEMS HIGH (20-27)
AF	30	0.4	5	11	8	6	36.7	26.7	20.0
AH	28	0.4	1	5	17	5	17.9	60.7	17.9
AS	721	9.9	144	67	210	300	9.3	29.1	41.6
BS	345	4.7	166	60	36	83	17.4	10.4	24.1
CF	67	0.9	3	21	20	23	31.3	29.9	34.3
CW	453	6.2	28	33	269	123	7.3	59.4	27.2
DF	213	2.9	73	40	100	0	18.8	46.9	0.0
ES	1.434	19.6	498	274	241	421	19.1	16.8	29.4
KS	54	0.7	15	21	11	7	38.9	20.4	13.0
LM	23	0.3	7	5	11	0	21.7	47.8	0.0
LP	1.539	21.0	350	440	418	331	28.6	27.2	21.5
OK	10	0.1	2	6	2	0	60.0	20.0	0.0
PP	1.903	26.0	1.134	249	520	0	13.1	27.3	0.0
WF	401	5.5	132	68	92	109	17.0	22.9	27.2
WS	91	1.2	41	3	0	47	3.3	0.0	51.6
GRAND TOTAL	7.312	100.0	2.599	1.303	1.955	1.455	17.8	26.7	19.9

* SEE APPENDIX TABLE A-3 FOR TREE SPECIES LISTING

TABLE 2

DISTRIBUTION OF HIGH RISK HAZARD TREES
BY CAMPGROUND AND NUMBER OF
TREES ON 54 CAMPGROUNDS IN
REGION 2

NUMBER OF CAMPGROUNDS WITH VARIOUS PERCENT HIGH RISK STEMS

	0-10%	11-20%	21-30%	31-40%	41-50%	51%+	TOTAL
A.	12	12	16	5	8	1	54

NUMBER OF STEMS WITHIN CAMPGROUNDS AT VARIOUS HIGH RISK LEVELS

B.	32	251	440	226	463	43	1,455

AVERAGE NUMBER OF HIGH RISK STEMS PER CAMPGROUND

C.	2.7	20.9	27.5	45.2	57.9	43.0	---

DISTRIBUTION OF HAZARD TREES WITH
A CLASS I DEFECT IN 54 CAMPGROUNDS
IN REGION TWO

TABLE 3

SPECIES	NUMBER OF TREES WITHOUT DEFECT	NUMBER OF TREES SAMPLED	NUMBER OF STEMS PER DEFECT: SLIME FLUX	NUMBER OF STEMS PER DEFECT: SMALL MECHANICAL INJURY
AF	5	30	0	14
AH	1	28	0	2
AS	144	721	2	235
BS	166	345	0	99
CF	3	67	0	30
CW	28	453	200	153
DF	73	213	0	72
ES	498	1.434	5	553
KS	15	54	0	24
LM	7	23	0	13
LP	350	1.539	7	893
OK	2	10	0	6
PP	1,134	1.903	2	339
WF	132	401	13	149
WS	41	91	0	17
GRAND TOTAL	2.599	7.312	229	2.599

DISTRIBUTION OF HAZARD TREES WITH
A CLASS II DEFECT IN 54 CAMPGROUNDS
IN REGION TWO

TABLE 4

SPECIES	NUMBER OF TREES WITHOUT DEFECT	NUMBER OF TREES SAMPLED	NUMBER OF STEMS PER DEFECT: LARGE MECHANICAL INJURY	FROST CRACK	LIGHTNING SCAR	BOLE CANKER	LIMB DEFECT	FORKED TREE
AF	5	30	5	9	0	0	1	0
AH	1	28	1	0	0	0	24	3
AS	144	721	143	6	6	234	143	73
BS	166	345	27	0	3	0	8	20
CF	3	67	19	6	0	2	0	3
CW	28	453	66	33	0	43	237	250
DF	73	213	28	12	1	3	25	34
ES	498	1,434	138	35	2	15	40	139
KS	15	54	9	1	0	1	0	5
LM	7	23	4	0	0	0	0	5
LP	350	1,539	286	44	17	47	80	219
OK	2	10	3	1	0	1	0	2
PP	1,134	1,903	106	21	11	22	113	224
WF	132	401	47	55	2	1	18	52
WS	41	91	6	1	0	0	0	2
GRAND TOTAL	2,599	7,312	888	224	42	369	689	1,031

DISTRIBUTION OF HAZARD TREES WITH
A CLASS III DEFECT IN 54 CAMPGROUNDS
IN REGION TWO

TABLE 5

SPECIES	NUMBER OF TREES WITHOUT DEFECT	NUMBER OF TREES SAMPLED	NUMBER OF STEMS PER DEFECT: DEAD TOP	DEAD TREE	BOLE CANKER DECAY	FUNKY KNOTS	CONKS	BASAL CAVITY	BUTT ROT	EXPOSED ROOT	LEANER	ROOT ROT
AF	5	30	0	0	0	0	0	1	6	4	0	0
AH	1	28	1	0	0	0	3	2	1	0	0	0
AC	144	721	15	55	114	1	118	10	63	15	1	4
BS	166	345	5	0	0	1	0	0	7	78	1	4
CF	3	67	1	5	0	0	0	1	13	11	0	0
CW	28	453	23	0	4	0	0	7	57	51	0	2
DF	73	213	7	1	1	0	1	0	20	19	0	1
ES	498	1,434	20	9	0	2	4	5	90	363	0	7
KS	15	54	0	0	0	0	0	0	1	7	0	0
LM	7	23	1	0	0	0	0	0	0	4	0	0
LP	350	1,539	37	7	0	0	3	2	35	291	0	7
OK	2	10	0	0	0	0	0	0	3	0	0	0
PP	1,134	1,903	17	3	0	0	0	1	26	84	2	2
WF	132	401	5	1	1	0	3	7	43	66	0	1
WS	41	91	2	0	0	0	0	0	6	42	0	0
GRAND TOTAL	2,599	7,312	134	81	120	4	132	36	371	1,035	4	28

DISTRIBUTION OF TREES WITH VARYING PERCENT SOUNDWOOD IN A TEN PERCENT SAMPLE OF TREES RISK RATED FOR HAZARD IN 54 CAMPGROUNDS IN REGION TWO

TABLE 6

SPECIES	NUMBER OF TREES SAMPLED	NUMBER OF TREES CORED	PERCENT OF TREES CORED	NUMBER OF STEMS AT FOUR LEVELS OF SOUNDWOOD			
				100% SOUND	99-50% SOUND	49-25% SOUND	24-1% SOUND
AF	30	8	27	2	3	3	0
AH	28	0	0	0	0	0	0
AS	721	88	12	23	26	30	9
BS	345	21	6	14	2	2	3
CF	67	18	27	5	8	5	0
CW	453	114	25	58	41	11	4
DF	213	48	22	28	12	5	3
ES	1,434	176	12	90	47	30	9
KS	54	3	5	1	1	1	0
LM	23	0	0	0	0	0	0
LP	1,539	111	7	78	22	10	1
OK	10	4	40	0	2	2	0
PP	1,903	91	5	68	18	5	0
WF	401	82	20	44	24	12	2
WS	91	9	10	3	5	1	0
GRAND TOTAL	7,312	773	10	414	211	117	31

TABLE 7

DISTRIBUTION OF DBH OF TREES WITH VARYING PERCENT SOUNDWOOD IN A TEN PERCENT SAMPLE OF TREES RISK RATED FOR HAZARD IN 54 CAMPGROUNDS IN REGION TWO

Tree Diameter at Breast Height (DBH)	Number of Trees Cored	Number of Stems at Four Levels of Soundwood 100%	99-50%	49-25%	24-1%
3.9 - 6.9	13	7	3	3	-
7.0 - 8.9	81	39	21	18	3
9.0 - 11.9	180	85	66	22	7
12.0 - 40.0	499	283	121	74	21
Total	773	414	211	117	31
PERCENT OF TREES CORED	-	54	27	15	4

APPENDIX A

TABLE A-1

1982

NATIONAL FOREST CAMPGROUNDS DESIGNATED FOR PAYMENT OF A FEE

Forest Service .. U.S. Department of Agriculture .. Rocky Mountain Region

COLORADO

ARAPAHO NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Clear Creek Idaho Springs	Clear Lake	8	$4.00
	Cold Springs	65	5.00
	Columbine	24	4.00
	Echo Lake	17	4.00
	Guanella Pass	9	4.00
	Mizpah	11	4.00
	W. Chicago Creek	15	4.00
	Pickle Gulch	20	Group[1]
Sulphur Hot Sulphur Springs	Arapaho Bay	77	$5.00
	Green Ridge	83	7.00
	Stillwater	145	7.00
	Willow Creek	35	5.00
Middle Park Kremmling	Horseshoe	6	$4.00
	South Fork	18	4.00
	Sugar Loaf	10	4.00
Dillon Frisco	Heaton Bay	83	$5.00
	McDonald Flats	44	3.00
	Peak One	79	6.00
	Pine Cove	50	3.00
	Prairie Point	39	3.00
	Prospector	108	5.00
	Gold Pan	14	Group[1]

GRAND MESA NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Collbran Collbran	Jumbo	26	$5.00
	Spruce Grove	16	5.00
Grand Junction Grand Junction	Carp Lake	20	$5.00
	Crag Crest	11	5.00
	Eggleston Lake	6	5.00
	Island Lake	42	5.00
	Little Bear	40	5.00
	Valley View	8	5.00
	Ward Lake	27	5.00

GUNNISON NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Taylor River Gunnison	Almont	10	$5.00
	Cement Creek	15	5.00
	Dinner Station	22	5.00
	Lakeview	35	5.00
	Lodgepole	16	5.00
	Lottis Creek	15	5.00
	North Bank	17	5.00
	One Mile	26	5.00
	Rivers End	14	5.00
Cebolla Gunnison	Cebolla	5	$4.00
	Deer Lakes	12	4.00
	Pitkin	22	5.00
	Quartz	10	4.00
	Slumgullion	18	5.00
	Spruce	9	4.00
	Williams Creek	20	5.00

PIKE NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Pikes Peak Colorado Springs	Colorado	63	$5.00
	Painted Rocks	15	5.00
	South Meadows	57	5.00
	Red Rocks	6	Group[1]
South Park Fairplay	Aspen	12	$5.00
	Blue Mountain	21	4.00
	Cove	5	5.00
	Happy Meadows	6	4.00
	Jefferson Creek	17	5.00
	Lodgepole	35	5.00
	Pipe Springs	14	4.00
	Reservoir	24	5.00
	Round Mountain	16	4.00
	Springer Gulch	15	5.00
	Spruce Grove	28	4.00
South Platte Lakewood	Baldy	8	$4.00
	Buffalo	41	4.00
	Burning Bear	13	4.00
	Deer Creek	12	4.00
	Devils Head	22	4.00
	Flat Rocks	20	4.00
	Geneva Park	27	4.00
	Indian Creek	10	4.00
	Kelsey	17	4.00
	Kenosha Pass	25	4.00
	Lone Rock	12	5.00
	Meridian	18	4.00
	Tramway	6	4.00
	Bailey	10	Group[1]
	Redskin	40	Group[1]

RIO GRANDE NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Alamosa La Jara	Alamosa	10	$4.00
	Lake Fork	19	5.00
Conejos La Jara	Aspen Glade	34	$5.00
	Conejos	16	5.00
	Elk Creek	31	5.00
	Spectacle Lake	24	5.00
	Trujillo Meadows	21	5.00
Creede Creede	Marshall Park	15	$5.00
	N. Clear Creek	25	4.00
	Palisade	13	5.00
	River Hill	20	5.00
	S. Clear Creek	16	4.00
	S. Clear Creek Falls	11	4.00
	Thirty Mile	33	5.00
Del Norte Del Norte	Beaver Creek	20	$5.00
	Big Meadows	45	5.00
	Park Creek	13	5.00
	Upper Beaver	13	5.00
Saguache Saguache	N. Crestone Creek	14	$5.00

TABLE A-1

ROOSEVELT NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Boulder Boulder	Kelly Dahl	46	$5.00
	Olive Ridge	56	5.00
	Pawnee	55	5.00
Estes Poudre Fort Collins	Ansel Watrous	16	$5.00
	Kelly Flats	23	5.00
	Mountain Park	55	5.00
	Sleeping Elephant	15	4.00
Redfeather Fort Collins	Bellaire Lake	13	$5.00
	S. Shore Dowdy Lake	31	5.00
	W. Shore Dowdy Lake	24	5.00
	West Lake	29	5.00

ROUTT NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Hahns Peak Steamboat Springs	Dumont lake	12	$5.00
	Hahns Peak Lake	26	5.00
	Hinman	13	4.00
	Meadows	33	5.00
	Seed House	25	5.00
North Park Walden	Aspen	7	$4.00
	Big Creek Lake	37	5.00
	Grizzly Creek	12	4.00
	Hidden Lakes	9	4.00
	Pines	11	4.00
Yampa Yampa	Blacktail Creek	8	$4.00
	Cold Springs	5	4.00
	Lynx Pass	11	4.00
	Stillwater	29	5.00
	Toponas Creek	6	4.00

SAN ISABEL NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Leadville Leadville	Baby Doe	50	$7.00
	Baby Doe Annex	26	7.00
	Belle of Colorado	19	7.00
	Lakeview	71	5.00
	Molly Brown	49	7.00
	Parry Peak	26	5.00
	Twin Peaks	38	5.00
	Tabor	38	7.00
	Printerboy	5	Group[1]
Salida Salida	Angel of Shavano	17	$5.00
	Cascade	19	5.00
	Chalk Lake	14	5.00
	Collegiate Peaks	29	5.00
	Cottonwood Lake	28	5.00
	Garfield	11	5.00
	Monarch Park	37	5.00
	Mt. Princeton	13	5.00
	O'Haver Lake	24	5.00
San Carlos Canon City	Alvarado	49	$5.00
	Bear Lake	15	5.00
	Blue Lake	15	5.00
	Cuchara	28	5.00
	Lake Isabel-Cisneros	25	5.00
	Lake Isabel-Southside	8	5.00
	Lake Isabel-St. Charles	15	5.00
	Ophir	32	5.00

[1]For groups by reservation only; fee varies with group size. Contact the Ranger District Office for reservations.

1-35-5-82(R)

SAN JUAN NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Animas Durango	Haviland Lake	45	$5.00
	Junction Creek	34	4.00
	Purgatory	14	4.00
	S. Mineral	23	4.00
	Chris Park	50	Group[1]
Dolores Dolores	Burro Bridege	15	$3.00
	Cayton	27	5.00
	Forks	6	5.00
	Mavreeso	14	4.00
	Priest Gulch	13	5.00
	West Dolores	13	4.00
Mancos Mancos	Kroeger	13	$4.00
	Thompson Park	51	4.00
Pagosa Pagosa Springs	Blanco River	18	$3.00
	Bridge	19	4.00
	Cimarrona	21	4.00
	East Fork	25	4.00
	Teal	15	5.00
	West Fork	28	4.00
	Williams Creek	69	4.00
	Wolf Creek	26	4.00
Pine Bayfield	Florida	20	$4.00
	Graham Creek	26	5.00
	Middle Mtn.	24	5.00
	Miller Creek	15	4.00
	North Canyon	22	4.00
	Old Timers	11	5.00
	Pine Point	30	5.00
	Transfer Park	25	4.00
	Vallecito	88	5.00

UNCOMPAHGRE NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Norwood Norwood	Matterhorn	23	$5.00
	Sunshine	15	5.00
Ouray Montrose	Amphitheater	33	$5.00

WHITE RIVER NATIONAL FOREST

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
Aspen Aspen	Difficult	48	$5.00
	Maroon Lake	43	5.00
Blanco Meeker	East Marvine	7	5.00
	Marvine	18	5.00
	North Fork	47	3.00
	Trappers Lake Bucks	10	5.00
	Trappers Lake Cutthroat	14	5.00
	Trappers Lake Shepperd Rim	20	5.00
	Trappers Lake Trapline	13	5.00
Holy Cross Minturn	Camp Hale	21	$5.00
	Gold Park	14	5.00
	Gore Creek	17	5.00
	Hornsilver	12	5.00
	Tigiwon	6	Group[1]
	Tigiwon Community House	20	Group[1]
Sopris Carbondale	Bogan Flats	37	$5.00
	Chapman	86	5.00
	Dearhamer	13	4.00
	Little Mattie	20	5.00
	Little Maud	22	6.00
	Mollie B	26	6.00
	Redstone	24	5.00

TABLE A-1

1982

NATIONAL FOREST CAMPGROUNDS DESIGNATED FOR PAYMENT OF A FEE

Forest Service .. U.S. Department of Agriculture ..

Rocky Mountain Region

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
NEBRASKA			
NEBRASKA NATIONAL FOREST			
Bessey Halsey	Cedars	20	$5.00
	Hardwoods	11	5.00
	Claypit		Group[1]
SOUTH DAKOTA			
BLACK HILLS NATIONAL FOREST			
Bearlodge Sundance, WY	Reuter	24	$4.00
Custer Custer	Bismarch Lake	28	$5.00
	Comanche Park	34	5.00
Harney Hill City	Ditch Creek	13	$4.00
	Dutchman	45	5.00
	Horsethief Lake	36	6.00
	Oreville	26	5.00
	Whitetail	17	5.00
Nemo Deadwood	Boxelder Fork	15	$4.00
	Dalton Lake	11	4.00
	Roubaix Lake	59	5.00
Pactola Rapid City	Pactola	57	$6.00
	Sheridan South Side	126	6.00
	Sheridan North Cove	58	Group[1]
WYOMING			
BIGHORN NATIONAL FOREST			
Buffalo Buffalo	222 Middle Fork	9	$4.00
	223 South Fork	15	4.00
Paintrock Greybull	224 Cabin Creek	4	$4.00
	225 Ranger Creek	10	4.00
	226 Shell Creek	11	4.00
Tensleep Worland	227 Boulder Park	34	$4.00
	228 Lakeview	11	4.00
	229 Sitting Bull	43	4.00
Tongue Sheridan	230 Dead Swede	23	$4.00
	231 Owen Creek	7	4.00
	232 Prune Creek	21	4.00
	233 Sibley Lake	10	4.00
	234 Tie Flume	25	4.00

FOREST Ranger District Office Location	Campground Site Name	No. of Units	Daily Fee
MEDICINE BOW NATIONAL FOREST			
Brush Creek Saratoga	Bow River	13	$4.00
	Lincoln Park	9	4.00
	Ryan Park	49	4.00
	Silver Lake	21	4.00
	South Brush Creek	21	4.00
Laramie Laramie	Brooklyn Lake	17	$4.00
	Lake Owen	38	4.00
	Libby Creek Pine	6	4.00
	Libby Creek Spruce	8	4.00
	Libby Creek Willow	16	4.00
	Nash Fork	29	4.00
	Pole Creek	18	4.00
	Sugarloaf	16	4.00
	Tie City	25	4.00
	Vedauwoo	11	4.00
	Yellow Pine	19	4.00
SHOSHONE NATIONAL FOREST			
Clarks Fork Powell	Bear Tooth Lake	21	$4.00
	Crazy Creek	16	4.00
	Fox Creek	27	4.00
	Hunter Peak	9	4.00
	Island Lake	20	4.00
	Lake Creek	6	4.00
Greybull Meeteetsee	Brown Mountain	6	$4.00
	Wood River	5	4.00
Lander Lander	Fiddlers Lake	13	$4.00
	Louis Lake	9	4.00
	Sinks Canyon	10	4.00
Wapiti Cody	Big Game	17	$4.00
	Clearwater	32	4.00
	Eagle Creek	20	4.00
	Elk Fork	12	4.00
	Hanging Rock	4	4.00
	Newton Creek	31	4.00
	Pahaska	24	4.00
	Rex Hale	8	4.00
	Sleeping Giant	6	4.00
	Three Mile	33	4.00
	Wapiti	41	4.00
Wind River Dubois	Brooks Lake	13	$4.00
	Double Cabin	15	4.00
	Falls	45	4.00
	Horse Creek	9	4.00

[1] For groups by reservation only; fee varies with group size. Contact the Ranger District Office for reservations.

TABLE A-2

FOREST ______ DISTRICT ______ SITE NAME ______

DATE OF INSPECTION ______ EVALUATED BY ______

				CODE
		UNIT NO	TREE NO	
RISK VALUE		D B H (MINIMUM 7")		
TREE SPECIES	A	1	Pinyon, junipers, scrub oak	01
		2	ponderosa pine, 5 needle pines, Douglas fir	02
		3	Spruce/fir, aspen, cottonwood, lodgepole pine	03
POTENTIAL TARGET(S)	B	1	trails (low use), signs, etc	04
		2	temporary structures, trails (heavy use)	05
		3	permanent structures, parked vehicles, people	06
DEFECT(S) PRESENT	C	0	no visible defect	07
		1	slime flux	08
			small mechanical injury	09
		2	large mechanical wounds	10
			frost cracks	11
			lightning scars	12
			bole cankers	13
			limb defects, brooms	14
			forked trees	15
		3	dead top	16
			dead trees	17
			bole cankers (decayed)	18
			punky knots	19
			conks	20
			basal cavity	21
			butt rot	22
			exposed roots	23
			leaner (unnatural)	24
			root rot	25
RISK RATING			LOW (0-9) MED (10-20) HIGH (21-27)	26
INTERNAL INSPECTION	4/		Increment borings (yr) taken	29
			inches sound wood	30
				31

COMMENTS

TABLE A-3

LISTING OF TREE SPECIES RISK RATED FOR HAZARD IN 54 CAMPGROUNDS IN REGION TWO

CODE	COMMON NAME	SCIENTIFIC NAME
AF	ALPINE FIR	Abies lasiocarpa
AH	ASH	Fraxinus pennsylvanica
AS	ASPEN	Populus tremuloides
BS	BLUE SPRUCE	Picea pungens
CF	CORKBARK FIR	Abies lasiocarpa var. arizonica
CW	COTTONWOOD	Populus angustifolia and acuminata
DF	DOUGLAS-FIR	Pseodotsuga menziesii
ES	ENGELMANN SPRUCE	Picea engelmanni
KS	KRUMHOLTZ SPRUCE	Picea sp.
LM	LIMBER PINE	Pinus flexilis
LP	LODGEPOLE	Pinus contorta var. latifolia
OK	OAK	Quercus sp.
PP	PONDEROSA PINE	Pinus ponderosa
WF	WHITE FIR	Abies concolor
WS	WHITE SPRUCE	Picea glauca

TABLE A-4

LISTING OF CAMPGROUNDS IN REGION TWO
ON WHICH TREES WERE RISK RATED FOR HAZARD

CODE	CAMPGROUND	CODE	CAMPGROUND
1	ECHO LAKE	22	CAYTON
2	WEST CHICAGO	23	WEST DOLORES
3	PAWNEE	24	HAVREESO
4	WESTLAKE	25	MILLER CREEK
5	BUFFALO	26	FLORIDA
6	BURNING BEAR	27	EAST FORK
7	DEER CREEK	28	WEST FORK
8	KELSEY	29	KROGER
9	FLAT ROCKS	30	PURGATORY
10	TWIN PEAKS	31	NORTH FORK
11	O'HAVER LAKE	32	CAMP HALE
12	CISNEROS	33	BOGAN FLATS
13	PARK CREEK	34	BESSEY (Hardwoods)
14	UPPER BEAVER CREEK	35	TIE FLUME
15	ELK CREEK	36	TIE CITY - UPPER
16	SPECTACLE LAKE	37	TIE CITY - LOWER
17	ALAMOSA	38	HUNTER PEAK
18	HIDDEN LAKE	39	CRAZY CREEK
19	PINES	40	BROWN MOUNTAIN
20	DUMONT LAKE	41	WAPITI
21	BLACKTAIL CREEK	42	DUTCHMAN

CODE	CAMPGROUND
43	HORSETHIEF
44	BOXELDER
45	PACTOLA
46	SPRUCE GROVE
47	CARP LAKE
48	LAKE VIEW
49	CEMENT CREEK
50	ONE MILE
51	NORTH BANK
52	CEBOLLA
53	AMPHITHEATRE
54	JACK'S CREEK

TABLE A5

NUMBER OF HAZARD TREES
BY SPECIES AND RISK RATING
IN 54 CAMPGROUNDS IN REGION TWO

SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
AF	30	16	8	6
AH	28	6	17	5
AS	721	211	210	300
BS	345	220	36	83
CF	67	24	20	23
CW	453	61	269	123
DF	213	113	100	0
ES	1,434	772	241	421
KS	54	11	11	7
LM	23	12	11	0
LP	1,539	790	418	331
OK	10	8	2	0
PP	1,903	1,383	520	0
WF	401	200	92	109
WS	91	44	47	0
	7,312	3,902	1,955	1,455

PERCENT OF TREES SAMPLED BY RISK
RATING IN 54 CAMPGROUNDS IN REGION TWO

TABLE A6

CAMPGROUND CODE	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
1	54	50.0	24.1	25.9
2	26	34.6	50.0	15.4
3	246	47.2	24.4	28.5
4	35	68.6	31.4	0.0
5	120	35.0	65.0	0.0
6	91	25.3	31.9	42.9
7	86	62.8	16.3	20.9
8	80	41.2	58.7	0.0
9	83	81.9	18.1	0.0
10	356	82.6	10.7	6.7
11	110	81.8	18.2	0.0
12	104	41.3	28.8	29.8
13	92	55.4	22.8	21.7
14	53	60.4	32.1	7.5
15	263	61.2	21.3	17.5
16	206	18.9	54.4	26.7
17	115	54.8	13.0	32.2
18	52	26.9	55.8	17.3
19	89	44.9	38.2	16.9
20	31	35.5	51.6	12.9
21	54	24.1	53.7	22.2
22	204	52.9	32.8	14.2
23	82	52.4	26.8	20.7
24	66	42.4	7.6	50.0
25	38	26.3	28.9	44.7
26	90	45.6	27.8	26.7
27	127	70.1	27.6	2.4
28	129	65.9	18.6	15.5
29	80	23.7	57.5	18.8
30	74	45.9	21.6	32.4
31	315	14.9	38.1	47.0
32	114	57.9	27.2	14.9
33	124	31.5	22.6	46.0
34	34	26.5	58.8	14.7
35	260	48.5	32.7	18.8
36	53	37.7	60.4	1.9
37	77	36.4	36.4	27.3
38	81	38.3	17.3	44.4
39	116	37.9	30.2	31.9
40	58	27.6	22.4	50.0
41	109	17.4	60.6	22.0
42	521	76.6	23.4	0.0
43	120	70.8	29.2	0.0
44	139	53.2	11.5	35.3
45	676	80.9	19.1	0.0

TABLE A6

PERCENT OF SAMPLE TREES BY RISK
RATING IN 54 CAMPGROUNDS IN REGION TWO

CAMPGROUND CODE *	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
46	218	64.7	17.9	17.4
47	233	48.5	6.9	44.6
48	157	40.1	28.7	31.2
49	40	42.5	27.5	30.0
50	116	44.8	29.3	25.9
51	81	44.4	18.5	37.0
52	68	30.9	5.9	63.2
53	134	50.0	22.4	27.6
54	232	59.5	16.8	23.7
	7,312	53.4	26.7	19.9

* SEE APPENDIX TABLE A-4 FOR CAMPGROUND LISTING

NUMBER AND PERCENT OF HAZARD TREES
BY SPECIES AND RISK RATING
ON 54 CAMPGROUNDS IN REGION 2

TABLE A7

CAMPGROUND CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
1	ES	54	27	50	13	24	14	26
2	AS	8	0	0	6	75	2	25
	LP	18	9	50	7	39	2	11
3	AF	12	7	58	2	17	3	25
	CF	66	23	35	20	30	23	35
	ES	97	46	47	22	23	29	30
	KS	54	36	67	11	20	7	13
	LP	17	4	24	5	29	8	47
4	PP	35	24	69	11	31	0	0
5	PP	120	42	35	78	65	0	0
6	LP	91	23	25	29	32	39	43
7	AS	2	1	50	1	50	0	0
	ES	47	33	70	3	6	11	23
	LP	37	20	54	10	27	7	19
8	DF	38	20	53	18	47	0	0
	PP	42	13	31	29	69	0	0
9	DF	18	15	83	3	17	0	0
	PP	65	53	82	12	18	0	0
10	AS	16	8	50	1	6	7	44
	LP	340	286	84	37	11	17	5
11	AS	4	0	0	4	100	0	0
	LP	1	0	0	1	100	0	0
	PP	105	90	86	15	14	0	0
12	AS	34	6	18	9	26	19	56
	DF	10	5	50	5	50	0	0
	ES	11	4	36	5	45	2	18
	LM	6	3	50	3	50	0	0
	LP	1	1	100	0	0	0	0
	PP	5	4	80	1	20	0	0
	WF	37	20	54	7	19	10	27
13	BS	78	46	59	14	18	18	23
	CW	13	4	31	7	54	2	15
	ES	1	1	100	0	0	0	0
14	BS	29	25	86	0	0	4	14

NUMBER AND PERCENT OF HAZARD TREES
BY SPECIES AND RISK RATING
ON 54 CAMPGROUNDS IN REGION 2

Table A-7

CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
	PP	24	7	29	17	71	0	0
15	AS	1	0	0	0	0	1	100
	BS	141	100	71	14	10	27	19
	CW	29	3	10	16	55	10	34
	ES	59	42	71	9	15	8	14
	PP	33	16	48	17	52	0	0
16	BS	2	2	100	0	0	0	0
	CW	185	28	15	111	60	46	25
	ES	19	9	47	1	5	9	47
17	BS	10	1	10	1	10	8	80
	CW	25	7	28	11	44	7	28
	DF	7	7	100	0	0	0	0
	ES	71	46	65	3	4	22	31
	PP	2	2	100	0	0	0	0
18	DF	18	4	22	14	78	0	0
	ES	8	2	25	3	38	3	38
	LP	17	8	47	7	41	2	12
	WF	9	0	0	5	56	4	44
19	DF	2	2	100	0	0	0	0
	ES	4	3	75	0	0	1	25
	LP	83	35	42	34	41	14	17
20	DF	4	0	0	4	100	0	0
	ES	24	11	46	10	42	3	13
	LP	3	0	0	2	67	1	33
21	AS	2	1	50	1	50	0	0
	LP	51	12	24	28	55	11	22
	WF	1	0	0	0	0	1	100
22	AS	2	0	0	0	0	2	100
	DF	4	0	0	4	100	0	0
	ES	198	108	55	63	32	27	14
23	ES	79	43	54	19	24	17	22
	PP	3	0	0	3	100	0	0
24	CW	6	0	0	1	17	5	83
	ES	59	27	46	4	7	28	47
	PP	1	1	100	0	0	0	0

NUMBER AND PERCENT OF HAZARD TREES
BY SPECIES AND RISK RATING
ON 54 CAMPGROUNDS IN REGION 2

Table A-7

CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
25	AS	14	0	0	4	29	10	71
	CW	1	0	0	0	0	1	100
	DF	1	0	0	1	100	0	0
	ES	16	9	56	1	6	6	38
	PP	6	1	17	5	83	0	0
26	AS	11	3	27	3	27	5	45
	CW	17	3	18	9	53	5	29
	ES	57	31	54	12	21	14	25
	PP	5	4	80	1	20	0	0
27	AS	1	0	0	0	0	1	100
	DF	19	14	74	5	26	0	0
	PP	72	54	75	18	25	0	0
	WF	35	21	60	12	34	2	6
28	AS	2	0	0	0	0	2	100
	CF	1	1	100	0	0	0	0
	CW	2	0	0	2	100	0	0
	DF	24	19	79	5	21	0	0
	ES	53	34	64	3	6	16	30
	PP	22	16	73	6	27	0	0
	WF	25	15	60	8	32	2	8
29	AS	12	0	0	12	100	0	0
	CW	29	3	10	22	76	4	14
	ES	8	5	63	0	0	3	38
	WF	31	11	35	12	39	8	26
30	AS	18	6	33	4	22	8	44
	DF	5	2	40	3	60	0	0
	ES	15	9	60	1	7	5	33
	WF	36	17	47	8	22	11	31
31	AS	315	47	15	120	38	148	47
32	LP	114	66	58	31	27	17	15
33	AS	31	1	3	2	6	28	90
	BS	56	34	61	4	7	18	32
	CW	32	3	9	18	56	11	34
	PP	4	0	0	4	100	0	0
	WF	1	1	100	0	0	0	0
34	AH	28	6	21	17	61	5	18
	DF	1	0	0	1	100	0	0

NUMBER AND PERCENT OF HAZARD TREES
BY SPECIES AND RISK RATING
ON 54 CAMPGROUNDS IN REGION 2

Table A-7

CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
	PP	5	3	60	2	40	0	0
35	ES	2	2	100	0	0	0	0
	LP	258	124	48	85	33	49	19
36	AS	1	0	0	0	0	1	100
	DF	47	16	34	31	66	0	0
	LP	2	2	100	0	0	0	0
	WF	3	2	67	1	33	0	0
37	AS	6	0	0	2	33	4	67
	DF	1	0	0	1	100	0	0
	ES	58	24	41	20	34	14	24
	LP	10	3	30	4	40	3	30
	WF	2	1	50	1	50	0	0
38	DF	1	1	100	0	0	0	0
	ES	26	14	54	2	8	10	38
	LP	54	16	30	12	22	26	48
39	ES	18	8	44	1	6	9	50
	LP	98	36	37	34	35	28	29
40	CW	9	1	11	4	44	4	44
	DF	1	1	100	0	0	0	0
	ES	35	12	34	2	6	21	60
	LM	7	2	29	5	71	0	0
	LP	6	0	0	2	33	4	67
41	CW	91	6	7	61	67	24	26
	DF	6	4	67	2	33	0	0
	LM	10	7	70	3	30	0	0
	LP	2	2	100	0	0	0	0
42	AS	1	0	0	1	100	0	0
	PP	520	399	77	121	23	0	0
43	ES	1	1	100	0	0	0	0
	OK	10	8	80	2	20	0	0
	PP	109	76	70	33	30	0	0
44	AS	2	0	0	0	0	2	100
	P[illegible]	46	30	65	16	35	0	0
	WS	91	44	48	0	0	47	52
45	P[illegible]	67[illegible]	547	81	12[illegible]	19	0	0

NUMBER AND PERCENT OF HAZARD TREES
BY SPECIES AND RISK RATING
ON 54 CAMPGROUNDS IN REGION 2

Table A-7

CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
46	AF	18	9	50	6	33	3	17
	ES	138	100	72	23	17	15	11
	WF	62	32	52	10	16	20	32
47	ES	205	99	48	16	8	90	44
	WF	28	14	50	0	0	14	50
48	LP	157	63	40	45	29	49	31
49	AS	6	0	0	2	33	4	67
	BS	17	12	71	2	12	3	18
	CW	14	3	21	7	50	4	29
	ES	2	1	50	0	0	1	50
	WF	1	1	100	0	0	0	0
50	AS	1	0	0	0	0	1	100
	BS	11	5	45	1	9	5	45
	DF	2	1	50	1	50	0	0
	LP	101	46	46	31	31	24	24
	PP	1	0	0	1	100	0	0
51	BS	1	1	100	0	0	0	0
	LP	78	34	44	14	18	30	38
	PP	2	1	50	1	50	0	0
52	ES	68	21	31	4	6	43	63
53	DF	4	2	50	2	50	0	0
	WF	130	65	50	28	22	37	28
54	AS	231	138	60	38	16	55	24
	ES	1	0	0	1	100	0	0

GRAND TOTAL	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
	7,312	3,902	53	1,955	27	1,455	20

APPENDIX B

TABLE B-1

COMPARISON OF THE NUMBER OF TREES RISK RATED FOR HAZARD USING TWO METHODS: CONSTANT VERSUS VARIABLE RISK VALUES FOR SPECIES AND THE CLASS III DEFECT: EXPOSED ROOTS

Risk Value	Total Trees Sampled	Trees Without Defect Number	%	Low (1-9) Number	%	Medium (10-20) Number	%	High (21-27) Number	%
Constant	7,312	2,599	35	1,303	18	1,955	27	1,455	20
Variable	7,312	2,599	35	1,285	18	2,409	33	1,001	14

DISTRIBUTION OF TREES RISK RATED FOR HAZARD
IN 54 CAMPGROUNDS IN REGION TWO USING A MODIFIED RISK RATING
VALUE FOR SPECIES AND THE CLASS III DEFECT: EXPOSED ROOTS

TABLE B-2

SPECIES *	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
AF	30	16	8	6
AH	28	6	17	5
AS	721	211	222	288
BS	345	226	103	16
CF	67	24	26	17
CW	453	61	307	85
DF	213	113	73	27
ES	1,434	772	542	120
KS	54	36	18	0
LM	23	12	11	0
LP	1,539	790	414	335
OK	10	8	2	0
PP	1,903	1,383	477	43
WF	401	200	150	51
WS	91	44	39	8
GRAND TOTAL	7,312	3,902	2,409	1,001

* SEE APPENDIX TABLE A-3 FOR SPECIES LISTING

PERCENT OF SAMPLE TREES BY RISK
RATING IN 54 CAMPGROUNDS IN REGION TWO
USING A MODIFIED RISK RATING VALUE FOR
SPECIES AND THE CLASS III DEFECT: EXPOSED ROOTS

TABLE B3

CAMPGROUND CODE	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
1	54	50.0	44.4	5.6
2	26	34.6	50.0	15.4
3	246	47.2	34.1	18.7
4	35	68.6	31.4	0.0
5	120	35.0	62.5	2.5
6	91	25.3	31.9	42.9
7	86	62.8	29.1	8.1
8	80	41.2	50.0	8.7
9	83	81.9	15.7	2.4
10	356	82.6	10.7	6.7
11	110	81.8	18.2	0.0
12	104	41.3	39.4	19.2
13	92	55.4	39.1	5.4
14	53	60.4	35.8	3.8
15	263	61.2	33.1	5.7
16	206	18.9	64.1	17.0
17	115	54.8	33.9	11.3
18	52	26.9	63.5	9.6
19	89	44.9	39.3	15.7
20	31	35.5	51.6	12.9
21	54	24.1	51.9	24.1
22	204	52.9	37.7	9.3
23	82	52.4	42.7	4.9
24	66	42.4	39.4	18.2
25	38	26.3	47.4	26.3
26	90	45.6	38.9	15.6
27	127	70.1	23.6	6.3
28	129	65.9	20.2	14.0
29	80	23.7	60.0	16.2
30	74	45.9	37.8	16.2
31	315	14.9	39.0	46.0
32	114	57.9	27.2	14.9
33	124	31.5	38.7	29.8
34	34	26.5	55.9	17.6
35	260	48.5	32.3	19.2
36	53	37.7	34.0	28.3
37	77	36.4	50.6	13.0
38	81	38.3	29.6	32.1
39	116	37.9	35.3	26.7
40	58	27.6	55.2	17.2
41	109	17.4	64.2	18.3
42	521	76.6	22.5	1.0
43	120	70.8	23.3	5.8
44	139	53.2	33.1	13.7

PERCENT OF SAMPLE TREES BY RISK
RATING IN 54 CAMPGROUNDS IN REGION TWO
USING A MODIFIED RISK RATING VALUE FOR
SPECIES AND THE CLASS III DEFECT: EXPOSED ROOTS

TABLE B3

CAMPGROUND CODE	TOTAL TREES SAMPLED	RISK RATING (0-9)	RISK RATING (10-20)	RISK RATING (21-27)
47	233	48.5	42.5	9.0
48	157	40.1	28.7	31.2
49	40	42.5	40.0	17.5
50	116	44.8	32.8	22.4
51	81	44.4	17.3	38.3
52	68	30.9	52.9	16.2
53	134	50.0	47.0	3.0
54	232	59.5	18.1	22.4
	7,312	53.4	32.9	13.7

* SEE APPENDIX TABLE A-4 FOR CAMPGROUND LISTING

NUMBER AND PERCENT OF HAZARD TREES BY CAMPGROUND AND SPECIES IN 54 CAMPGROUNDS IN REGION TWO USING A MODIFIED RISK RATING VALUE FOR SPECIES AND THE CLASS III DEFECT:EXPOSED ROOTS

TABLE B4

CAMPGROUND CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
1	ES	54	27	50	24	44	3	6
2	AS	8	0	0	6	75	2	25
	LP	18	9	50	7	39	2	11
3	AF	12	7	58	2	17	3	25
	CF	66	23	35	26	39	17	26
	ES	97	46	47	34	35	17	18
	KS	54	36	67	18	33	0	0
	LP	17	4	24	4	24	9	53
4	PP	35	24	69	11	31	0	0
5	PP	120	42	35	75	63	3	2
6	LP	91	23	25	29	32	39	43
7	AS	2	1	50	1	50	0	0
	ES	47	33	70	14	30	0	0
	LP	37	20	54	10	27	7	19
8	DF	38	20	53	15	39	3	8
	PP	42	13	31	25	60	4	10
9	DF	18	15	83	3	17	0	0
	PP	65	53	82	10	15	2	3
10	AS	16	8	50	1	6	7	44
	LP	340	286	84	37	11	17	5
11	AS	4	0	0	4	100	0	0
	LP	1	0	0	1	100	0	0
	PP	105	90	86	15	14	0	0
12	AS	34	6	18	11	32	17	50
	DF	10	5	50	5	50	0	0
	ES	11	4	36	6	55	1	9
	LM	6	3	50	3	50	0	0
	LP	1	1	100	0	0	0	0
	PP	5	4	80	1	20	0	0
	WF	37	20	54	15	41	2	5
13	BS	78	46	59	27	35	5	6
	CW	13	4	31	9	69	0	0
	ES	1	1	100	0	0	0	0
14	BS	29	25	86	2	7	2	7

CAMPGROUND CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
	PP	24	7	29	17	71	0	0
15	AS	1	0	0	0	0	1	100
	BS	141	100	71	37	26	4	3
	CW	29	3	10	21	72	5	17
	ES	59	42	71	13	22	4	7
	PP	33	16	48	16	48	1	3
16	BS	2	2	100	0	0	0	0
	CW	185	28	15	125	68	32	17
	ES	19	9	47	7	37	3	16
17	BS	10	1	10	6	60	3	30
	CW	25	7	28	15	60	3	12
	DF	7	7	100	0	0	0	0
	ES	71	46	65	18	25	7	10
	PP	2	2	100	0	0	0	0
18	DF	18	4	22	13	72	1	6
	ES	8	2	25	6	75	0	0
	LP	17	8	47	7	41	2	12
	WF	9	0	0	7	78	2	22
19	DF	2	2	100	0	0	0	0
	ES	4	3	75	1	25	0	0
	LP	83	35	42	34	41	14	17
20	DF	4	0	0	4	100	0	0
	ES	24	11	46	10	42	3	13
	LP	3	0	0	2	67	1	33
21	AS	2	1	50	1	50	0	0
	LP	51	12	24	27	53	12	24
	WF	1	0	0	0	0	1	100
22	AS	2	0	0	0	0	2	100
	DF	4	0	0	3	75	1	25
	ES	198	108	55	74	37	16	8
23	ES	79	43	54	33	42	3	4
	PP	3	0	0	2	67	1	33
24	CW	6	0	0	2	33	4	67
	ES	59	27	46	24	41	8	14
	PP	1	1	100	0	0	0	0

CAMPGROUND CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
25	AS	14	0	0	5	36	9	64
	CW	1	0	0	0	0	1	100
	DF	1	0	0	1	100	0	0
	ES	16	9	56	7	44	0	0
	PP	6	1	17	5	83	0	0
26	AS	11	3	27	3	27	5	45
	CW	17	3	18	10	59	4	24
	ES	57	31	54	21	37	5	9
	PP	5	4	80	1	20	0	0
27	AS	1	0	0	0	0	1	100
	DF	19	14	74	4	21	1	5
	PP	72	54	75	14	19	4	6
	WF	35	21	60	12	34	2	6
28	AS	2	0	0	0	0	2	100
	CF	1	1	100	0	0	0	0
	CW	2	0	0	2	100	0	0
	DF	24	19	79	1	4	4	17
	ES	53	34	64	11	21	8	15
	PP	22	16	73	3	14	3	14
	WF	25	15	60	9	36	1	4
29	AS	12	0	0	12	100	0	0
	CW	29	3	10	22	76	4	14
	ES	8	5	63	1	13	2	25
	WF	31	11	35	13	42	7	23
30	AS	18	6	33	7	39	5	28
	DF	5	2	40	3	60	0	0
	ES	15	9	60	6	40	0	0
	WF	36	17	47	12	33	7	19
31	AS	315	47	15	123	39	145	46
32	LP	114	66	58	31	27	17	15
33	AS	31	1	3	2	6	28	90
	BS	56	34	61	20	36	2	4
	CW	32	3	9	22	69	7	22
	PP	4	0	0	4	100	0	0
	WF	1	1	100	0	0	0	0
34	AH	28	6	21	17	61	5	18
	DF	1	0	0	1	100	0	0

CAMPGROUND CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
	PP	5	3	60	1	20	1	20
35	ES	2	2	100	0	0	0	0
	LP	258	124	48	84	33	50	19
36	AS	1	0	0	0	0	1	100
	DF	47	16	34	17	36	14	30
	LP	2	2	100	0	0	0	0
	WF	3	2	67	1	33	0	0
37	AS	6	0	0	2	33	4	67
	DF	1	0	0	0	0	1	100
	ES	58	24	41	32	55	2	3
	LP	10	3	30	4	40	3	30
	WF	2	1	50	1	50	0	0
38	DF	1	1	100	0	0	0	0
	ES	26	14	54	12	46	0	0
	LP	54	16	30	12	22	26	48
39	ES	18	8	44	7	39	3	17
	LP	98	36	37	34	35	28	29
40	CW	9	1	11	5	56	3	33
	DF	1	1	100	0	0	0	0
	ES	35	12	34	20	57	3	9
	LM	7	2	29	5	71	0	0
	LP	6	0	0	2	33	4	67
41	CW	91	6	7	66	73	19	21
	DF	6	4	67	1	17	1	17
	LM	10	7	70	3	30	0	0
	LP	2	2	100	0	0	0	0
42	AS	1	0	0	1	100	0	0
	PP	520	399	77	116	22	5	1
43	ES	1	1	100	0	0	0	0
	OK	10	8	80	2	20	0	0
	PP	109	76	70	26	24	7	6
44	AS	2	0	0	0	0	2	100
	PP	46	30	65	7	15	9	20
	WS	91	44	48	39	43	8	9
45	PP	676	547	81	126	19	3	0

TABLE B4 CONTINUED

CODE	SPECIES	TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
46	AF	18	9	50	6	33	3	17
	ES	138	100	72	30	22	8	6
	WF	62	32	52	13	21	17	27
47	ES	205	99	48	93	45	13	6
	WF	28	14	50	6	21	8	29
48	LP	157	63	40	45	29	49	31
49	AS	6	0	0	2	33	4	67
	BS	17	12	71	5	29	0	0
	CW	14	3	21	8	57	3	21
	ES	2	1	50	1	50	0	0
	WF	1	1	100	0	0	0	0
50	AS	1	0	0	0	0	1	100
	BS	11	5	45	6	55	0	0
	DF	2	1	50	0	0	1	50
	LP	101	46	46	31	31	24	24
	PP	1	0	0	1	100	0	0
51	BS	1	1	100	0	0	0	0
	LP	78	34	44	13	17	31	40
	PP	2	1	50	1	50	0	0
52	ES	68	21	31	36	53	11	16
53	DF	4	2	50	2	50	0	0
	WF	130	65	50	61	47	4	3
54	AS	231	138	60	41	18	52	23
	ES	1	0	0	1	100	0	0

TOTAL TREES SAMPLED	RISK RATING (0-9)	PERCENT OF TOTAL	RISK RATING (10-20)	PERCENT OF TOTAL	RISK RATING (21-27)	PERCENT OF TOTAL
7,312	3,902	53	2.409	33	1,001	14

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Tree Hazard Control on Recreation Sites . . .

estimating local budgets

LEE A. PAINE

ABSTRACT: Tree hazard control efforts on recreation sites are subject to budget and administrative restrictions. To make the most effective use of available control funds, priorities should be assigned to various classes of tree defects and a budget set up. With the method provided, local priorities are based on cost effectiveness. Some guidelines and a worksheet for planning a local budget are suggested.

RETRIEVAL TERMS: accident costs; hazard control costs; forest safety; recreation budget; accident prevention; hazard control priorities; tree defect.

OXFORD: 907.2:304:677:416

Paine 1967

Removal of trees or limbs that pose a safety hazard in campgrounds and picnic areas is a costly process. Nevertheless, the need for such "tree hazard control" is increasing because of mounting use of forest recreation areas. Foresters who must cope with this problem need answers to two kinds of budget questions: When the standard of control is limited by a fixed budget, how can we spend the money most effectively? Or, when management policy specifies certain standards, how do we estimate costs of meeting these standards?

If you have such a problem, this note can help you work up the answers. It suggests a procedure for assigning local control priorities--based on analysis of cost-effectiveness--to classes of tree defects.

An earlier study on forest recreation sites in California[1] suggested that highest priorities be given to reduction of limb defects in oaks and removal of trees with bole defects in other hardwoods and in conifers. But these statewide priorities are not necessarily best in local situations. And they may not be especially helpful in preparing your local budgets. To help you set local priorities, we suggest the following guidelines and worksheet for estimating effectiveness of control by class of defect and by site.

Defects are considered in four classes: root, butt, bole, and limb. These classes also apply to "failures"--a term used to refer to a tree or part of a tree which represented a hazard both because it fell during a season when the site was often occupied and because it was large enough to require clean-up even though not involved in an accident.

The relative effectiveness of control (E) for each class of defect for any given area may be defined by the relationship

$$E = \frac{L}{C},$$

in which:

L = annual property losses resulting from past failures plus losses prevented by removal of defects, and

C = inspection and removal costs for control of hazard.

Three types of information are necessary before this equation can be applied to a specific area:

[1]Paine, Lee A. *Effective tree hazard control on forested recreation sites...losses and protection costs evaluated.* U.S. Forest Serv. Res. Note PSW-157, 8 pp., illus. Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 1967.

X

ESTIMATING EFFECTIVENESS OF HAZARD CONTROL

BY CLASS OF DEFECT--BUDGET REQUIREMENTS

	Class of defect or failure			
	Bole	Butt	Limb	Root
r = Average property loss per failure[1/]	$386	$264	$31	$263
s = Annual number of in-season failures of each class on area	2	1	2	5
t = Annual number of potential in-season failures prevented by control	2	2	40 (trees)	0
L = POTENTIAL ANNUAL LOSS FROM EACH TYPE OF DEFECT = r (s + t)	$1,544	$792	$1,302	$1,315
u = Average inspection costs per tree for each class of defect	$0.10	$0.15	$0.10	$1.50
v = Total number of trees to be inspected on area	1,000	1,000	1,000	1,000
w = Annual inspection costs = u x v	$100	$150	$100	$1,500
x = Cost per defective tree for removal of defect[1/]	$200	$200	$50	$200
y = Annual removal costs = x(s + t)	$800	$600	$2,100	$1,000
C = TOTAL ANNUAL CONTROL COST = w + y	$900	$750	$2,200	$2,500
E = EFFECTIVENESS OF CONTROL FOR EACH CLASS OF DEFECT = L/C	1.7	1.1	0.6	0.5
E' = EFFECTIVENESS OF CONTROL FOR SITE = $\frac{\Sigma L}{\Sigma C}$ [2/]	0.8			

1/ Figures shown for (r) and (x) apply to conifers and hardwoods other than oak; see sample worksheet (page 5) for values applicable specifically to oak, pine, or fir. Also see Paine, op. cit., for derivation of property loss and inspection cost values.

2/ Σ = summation of.

(s) annual number of in-season failures of each class on the area,

(t) annual number of in-season failures prevented by control; i.e., number of trees from which defects were removed, and

(v) total number of trees to be inspected on the area.

To minimize yearly variations, annual failures (s + t) should represent average values for recent years, excluding unique occurrences such as large-scale blowdown. Situations which are unpredictable on a local basis can be covered in area or statewide budgets.

For convenience of agencies or units participating in the California tree failure report program, a local summary of in-season failures may be requested from this Station. The worksheet (page 5) may be copied to provide a convenient form for determination of budget figures and effectiveness of control, by defect class and by site.

Use of the worksheet is illustrated by example on page 2. In this case we have assumed a mixed conifer population (v) of 1,000 trees subject to inspection, with actual failures (s) = 2, 1, 2, and 5, and controlled failures (t) = 2, 2, 40, and 0. After entering these figures, the appropriate property loss (r) and removal cost (x) factors are selected from the worksheet on page 5. The remaining values are then easily determined as indicated.

The highest value of E(1.7) indicates that reduction of hazardous bole defect will be most effective, with butt, limb, and root defect control next in order.

In the illustration, the losses from bole and butt defect exceed the costs of control (E > 1). And, because of the high number of trees with potential limb failures, limb defect control has become more effective in this situation than root defect control.

A budget of $6,350(ΣC) would presumably cover complete control. If your control budget were limited to $1,600, however, the values of E indicate that the funds should be used primarily to control bole and butt defect.

If your inspection cycle is 2 years or more, the in-season failures (s) should include the number of in-season failures occurring within the entire cycle. You can then read 'annual" as 'periodic" values.

Priority for control of any given site can be set according to the relative effectiveness of site control (E'). To permit comparison of sites, effectiveness of control must be based on actual costs of control without regard to the sources of funds. When it comes to budgeting funds, local timber sales and other control or improvement programs may provide part of the working capital. For sites with no history of failures or previous removals, priority should depend on occupancy during the use season.

Area priorities may need to be established for the purpose of allotting funds within a region. For each defect class, separately, the area value

$$E'' = \frac{\Sigma L(\text{all sites})}{\Sigma C(\text{all sites})}.$$

After you have defined, within budget restrictions, which classes of defect can be effectively controlled, sites or areas can be worked in order of decreasing values of E' or E".

Inspection and removal costs developed from local experience may be substituted for those given in the worksheet. The same thing holds for average losses if local values differ significantly from statewide averages.

Rating priorities by this method assumes that efficiency of detection is reasonably comparable for each class of defect. We have no measure of detection efficiency available as yet, but relative difficulty of detection is reflected in the inspection times (and inspection costs) assigned to each class of defect.

The rating procedure depends on local records of tree failures and controlled hazards. Some administrative units now keep such records as a matter of course; others would have to initiate them for the first time. But having a sound basis for setting control budgets and directing control emphasis should far outweigh the nuisance of keeping records, especially for areas with heavy recreational use.

Budgets are often too small to allow detailed examination of every tree, even if present methods for detection and evaluation of hazard were not so time-consuming. With limited budgets and in the absence of specified goals, priority rating places greater emphasis on locally important classes of defect and results in more effective use of available money. Furthermore, since realistic administrative policy will never be set at complete elimination of hazard, a required level of control will be obtained more easily by determining which targets provide the greatest opportunity for control.

The Author

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WORKSHEET FOR ESTIMATING EFFECTIVENESS OF HAZARD CONTROL

BY CLASS OF DEFECT--BUDGET REQUIREMENTS

District ____________________ Site name ____________________

	Class of defect or failure			
	Bole	Butt	Limb	Root
r = Average property loss per failure[1/]	$____	$____	$____	$____
s = Annual number of in-season failures of each class on area	____	____	____	____
t = Annual number of potential in-season failures prevented by control	____[2/]	____	____ (trees)	____[3/]
L = POTENTIAL ANNUAL LOSS FROM EACH TYPE OF DEFECT = r (s + t)	$____	$____	$____	$____
u = Average inspection costs per tree for each class of defect	$0.10	$0.15	$0.10	$1.50
v = Total number of trees to be inspected on area	____	____	____	____
w = Annual inspection costs = u × v	$____	$____	$____	$____
x = Cost per defective tree for removal of defect[1/]	$____	$____	$____	$____
y = Annual removal costs = x(s + t)	$____	$____	$____	$____
C = TOTAL ANNUAL CONTROL COST = w + y	$____	$____	$____	$____
E = EFFECTIVENESS OF CONTROL FOR EACH CLASS OF DEFECT = L/C	____	____	____	____

E' = EFFECTIVENESS OF CONTROL FOR

SITE = $\frac{\Sigma L^{4/}}{\Sigma C}$ ____________

1/ Select values for (r) and (x) from following table:

	Bole	Butt	Limb	Root
	- - - - - - (dollars) - - - -			
(r) Conifers and "other hardwoods"	386	264	31	263
Pine	461	44	15	284
Fir	584	267	20	494
Oak	3	0	214	45
(x) Conifers and "other hardwoods"	200	200	50	200
Oak	175	175	75	175

2/ Include removed snags as prevented bole failures.

3/ Include removed "leaners" or unstable trees as prevented root failures.

4/ Summarize only for classes of defect which will be controlled.